

Final Report

DEVELOPMENT OF MULTIPLE USER AMTRAN ON THE DATACRAFT DC6024

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TELEDYNE

BROWN ENGINEERING

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DEVELOPMENT OF MULTIPLE USER AMTRAN ON
THE DATACRAFT DC 6024

By

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Prepared For

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ABSTRACT

A multiple user version of AMTRAN has been implemented on the Datacraft DC6024 computer with 24K of core. This version differs from previous ones in that the major portion of the multiple user logic is incorporated in the main program which remains in core during all AMTRAN processes. A detailed flowchart of the main program is provided as documentation of the multiple user capability. Activities were directed toward perfecting this capability, providing new features in response to user needs and requests, providing a two-dimensional array AMTRAN containing multiple user logic, and providing documentation as these tasks progressed.

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1. INTRODUCTION

This final report describes in detail the work performed during the period December 25, 1971 through February 23, 1973 and is submitted in accordance with the requirements of Contract No. NAS8-26756.

In the following pages, Teledyne Brown Engineering presents a discussion of the activities and accomplishments pertaining to the development of the AMTRAN system on the Datacraft DC6024. Previous documents generated on this contract provide additional details and background on the final results described herein.

2. TECHNICAL DISCUSSION

2.1 MULTIPLE USER AMTRAN IMPLEMENTATION

The primary concern was focused on the development and implementation of a multiple user version of AMTRAN which has the capability of handling n users, but would initially provide service for up to eight users at a time because of hardware limitations. With the addition of special system software, the major portion of the multiple user logic was incorporated into a main program which is core-resident, whereas the 15 other modules that constitute AMTRAN are overlayed as necessary. The methods described in the following paragraph determine what user is processed and how long a user may execute if other users are also executing.

Whenever a user calls up, hangs up, or fills a buffer, his common is immediately swapped into core, and the system responds to his requests. When more than one user is in the process of executing AMTRAN statements or programs, the main program allows one user to execute for 5 seconds and then it writes this user's common onto the disk and places him in the execution queue. The first user in the execution queue is swapped into core and is allowed to run for the 5-second time interval unless another user calls up, hangs up, or fills a buffer. When his time has been expended, another user is then allowed to execute. The program logic continues in this manner. Additional precautions were taken to ensure that two users could not access the same file simultaneously. Because only three modems were available on the system, the complete multiple user logic checkout was accomplished with three users.

An accounting technique was incorporated into this system which reflects the number of used seconds for each active AMTRAN user. The time during which the user was attached to any of the 16 available console program files and was executing AMTRAN statements is recorded in the next to last word in each file. (In some cases, time is charged to the user while the system is waiting for him to fill a buffer. For instance, the case in which only one user is active falls into this category.) The number of seconds used while the user was attached to the file from which he has been running is displayed when the user requests a different console program file.

Modifications were made to provide additional information to the main program concerning active users so that the logic involving sense switch fourteen detection and multiple user logic errors could be expedited. Within this new overlay structure, the functions of sense switches thirteen and fourteen were effected, although the complexity of sense switch fourteen was significantly increased and required extra attention. The AMTRAN operator STATUS which allows the user to list his sense switch settings is also available in the new system.

The implementation of this system necessitated the separation of some of the modules which had been previously combined in earlier multiple user versions. More core is required for module combinations. For detailed flowcharting of the main program of multiple user AMTRAN, see the appendix.

2.2 SYSTEM MODIFICATIONS AND CAPABILITY EXTENSIONS

When AMTRAN was recompiled under extended precision so that computations could be made with greater accuracy, several system errors and other inconsistencies surfaced. Teledyne Brown Engineering personnel added constant percentage tolerance tests in the area involving AMTRAN logical IF statements and also added a specific tolerance before integerizing a floating point number for the INTEGER operator. As more users gained access to AMTRAN, other errors were detected and corrected. One occurred when embedded IF tests did not contain an "else" clause. Another involved allowing the passing of constants to console programs, although variables were necessary because data or results of operations were stored in these parameters during execution. Two errors involving the operator PLOTS and one involving subscript checking were corrected.

During the work period, logic was added to permit the operator READSC, which enables the user to use the joystick for graphic input, to be included in AMTRAN. The INPUT operator was modified to allow the user to input 80 characters per line. Math routines for the math file were reorganized and checked out. Two AMTRAN modules were modified to check the validity of the console program directory after it is packed. For user

convenience, a message was incorporated to warn users when they enter the store mode if the maximum number of console programs has been reached. The logic was added to ensure that the input of constants occurs in 11 significant figures. The capability to allow the user to output more significant figures to the right of the decimal point or to choose an integer output by sense switch selection was made available. Providing for text variables, extending the editing capabilities, and providing an ARCTAN which covers the entire output range of $-\pi$ to π were not accomplished because higher priorities were determined by user needs and requests.

In December 1972, AMTRAN was condensed again into 16K of core but was later extended and checked out on the Datacraft DC6024 at Marshall Space Flight Center with 32K of core in February 1973. Because of the unavailability of magnetic tape drives, a disk-to-tape copy subroutine was not written.

2.3 TWO-DIMENSIONAL ARRAY AMTRAN IMPLEMENTATION

Two-dimensional array AMTRAN was implemented and checked out on the Datacraft. All corrections and improvements to the one-dimensional array system, including multiple user modifications, were added to the two-dimensional array AMTRAN.

The operator TYPE was changed to WRITE; however, SHIFT was not changed to ROTATE because of user recommendation. The software was modified to allow square brackets to be used interchangeably with parentheses. Subscripting was changed so that it is now accomplished by using parentheses to enclose the subscripts instead of using the operator SUB which no longer exists in two-dimensional array AMTRAN. Therefore, the use of implied multiplication was eliminated. The operator INPUT was changed to convert all characters to AMTRAN codes and to store these codes as floating point numbers if the first character is alphabetic.

Three console programs were written for this version of AMTRAN which provide multiplication of matrices, accessing the diagonal of a matrix, and transposition of a matrix for the user.

Provisions for the disk storage of user data were incorporated into the system and checked out. A new explain file with descriptions of the new operators and examples of their usage was included in this effort.

2.4 DOCUMENTATION AND USER SUPPORT

The following documentation was completed during the work period:

- Software documentation for a portion of the multiple user AMTRAN for two users was prepared and presented to Computational Laboratory personnel at Marshall Space Flight Center.
- A portion of the documentation for the improved routines for the math file was provided by Teledyne Brown Engineering personnel. This documentation included a new format with a more detailed explanation of the method used in each program, a listing of the routine, and a sample of how each program can be used to solve problems.
- A supplement to the AMTRAN users' manual was completed, and it contained all aspects of two-dimensional arrays, including array construction and subscripting, array arithmetic, and the output of two-dimensional arrays.
- Approximately one-half of the documentation was completed for the multiple user, one-dimensional array AMTRAN which closely followed the level of detail in the document entitled, "AMTRAN System Design and Software Description". This document which describes the 8K 1130 AMTRAN system was not completed because two-dimensional AMTRAN preempts much of that material and requires extensive new documentation.

In the area of software support, the following activities occurred:

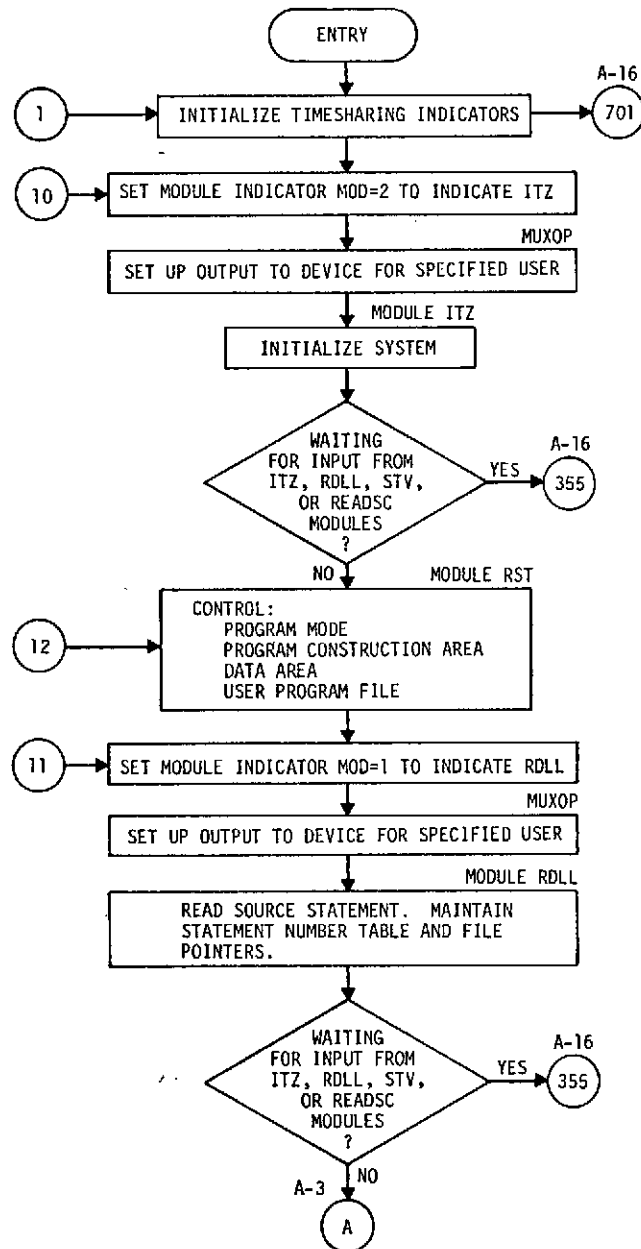
- Instructional assistance was provided to new users.
- Software support for AMTRAN demonstrations was given locally and at Oak Ridge, Tennessee.
- Two presentations were given at a tri-state mathematics teachers' conference at Auburn University at Auburn, Alabama.
- Users' manuals, software documentation, and binary dumps of the 8K 1130 version of AMTRAN were sent to two colleges.

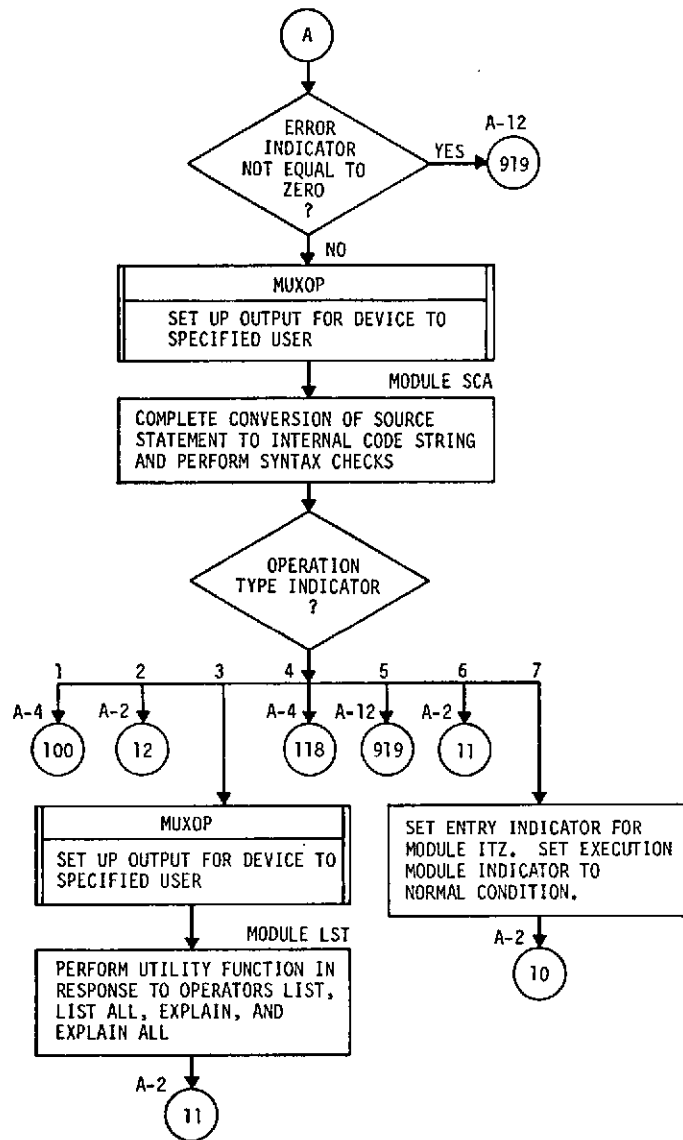
2.5 PREVIOUSLY SUBMITTED DOCUMENTATION

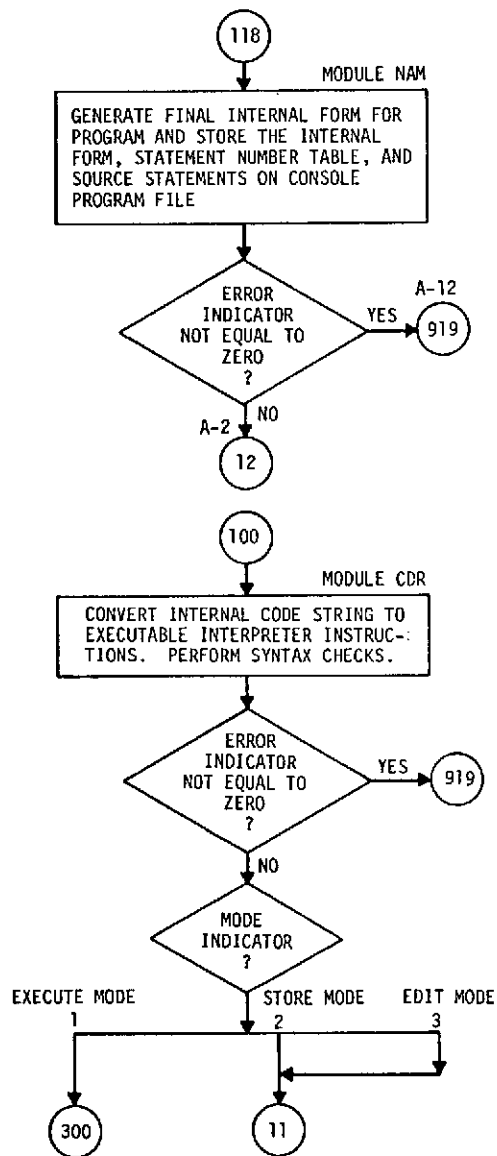
Listed below are documents that were previously generated on Contract NAS8-26756.

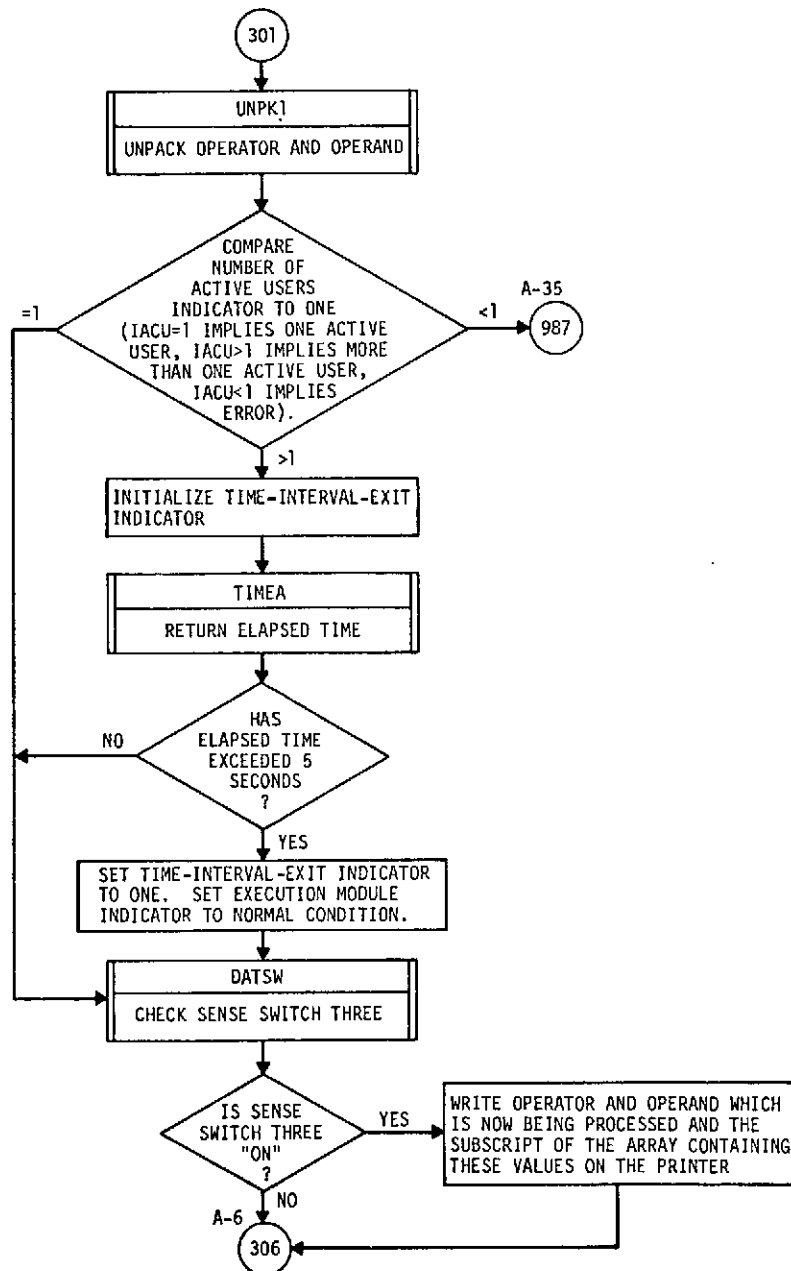
- "AMTRAN Users' Manual", Teledyne Brown Engineering Report No. SE-COMP-1399, September 1971
- "Supplement to AMTRAN Users' Manual", Teledyne Brown Engineering Report No. SE-COMP-1399-A, August 1972
- "Development of AMTRAN on the Datacraft DC6024", Teledyne Brown Engineering Report No. MSFC-SE-1528, May 1972.

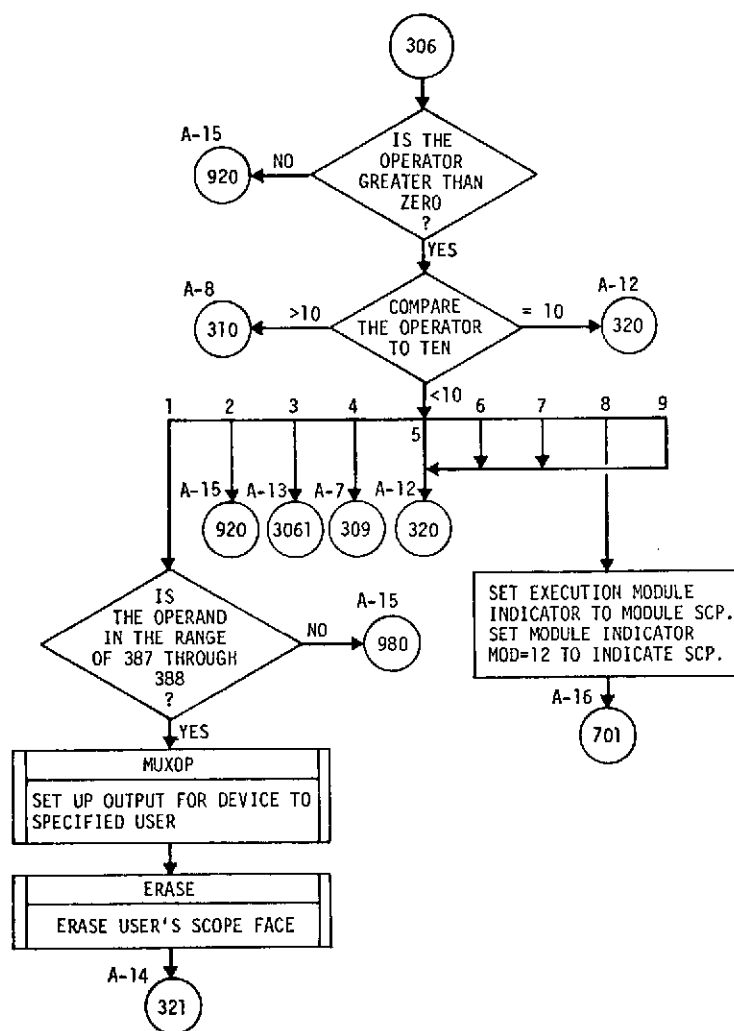
APPENDIX. FLOWCHARTS FOR MULTIPLE
USER AMTRAN SYSTEM

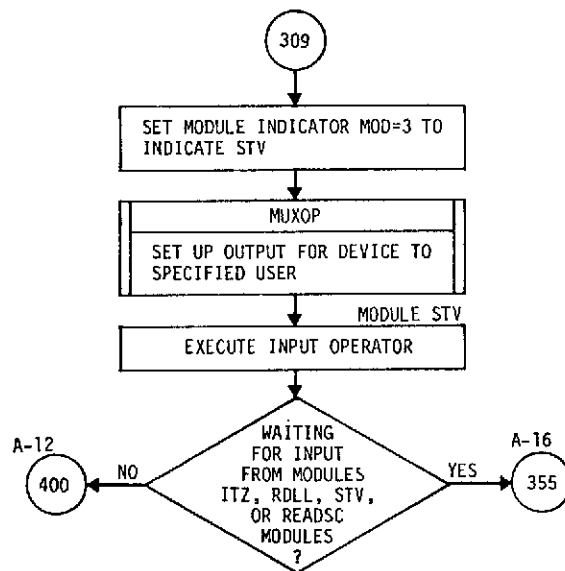
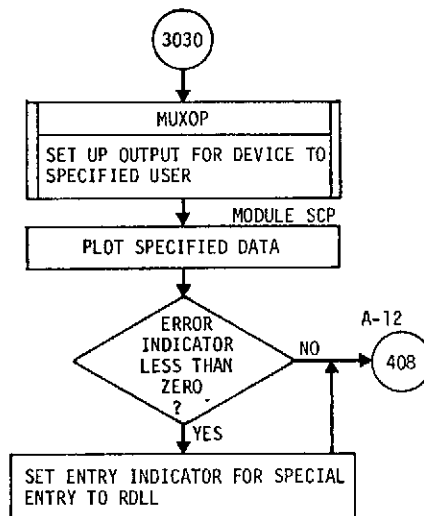


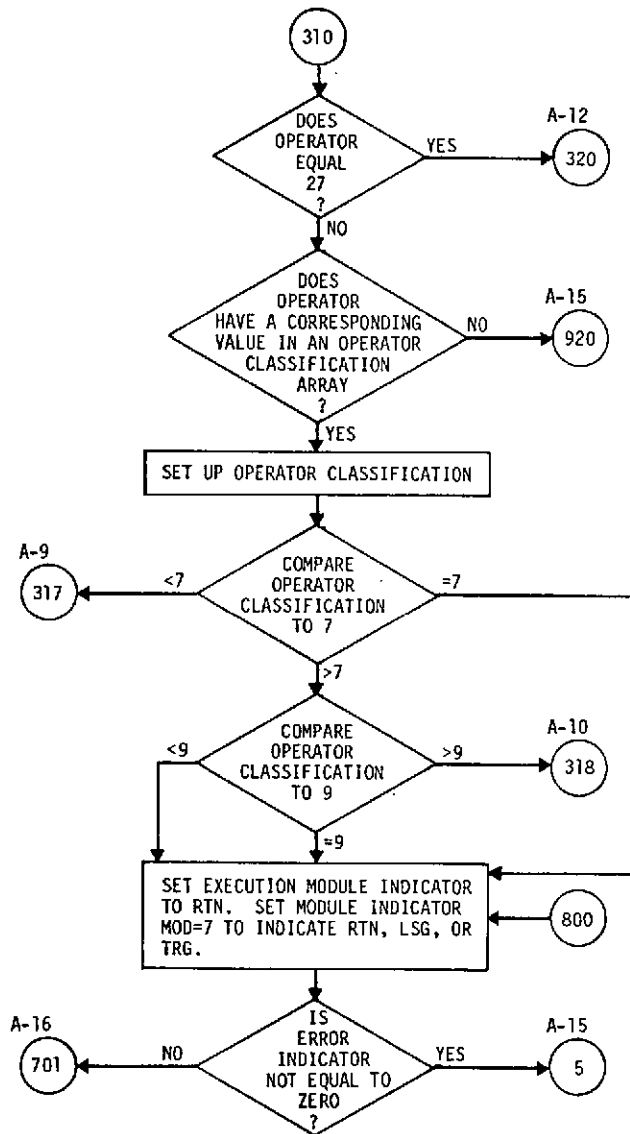


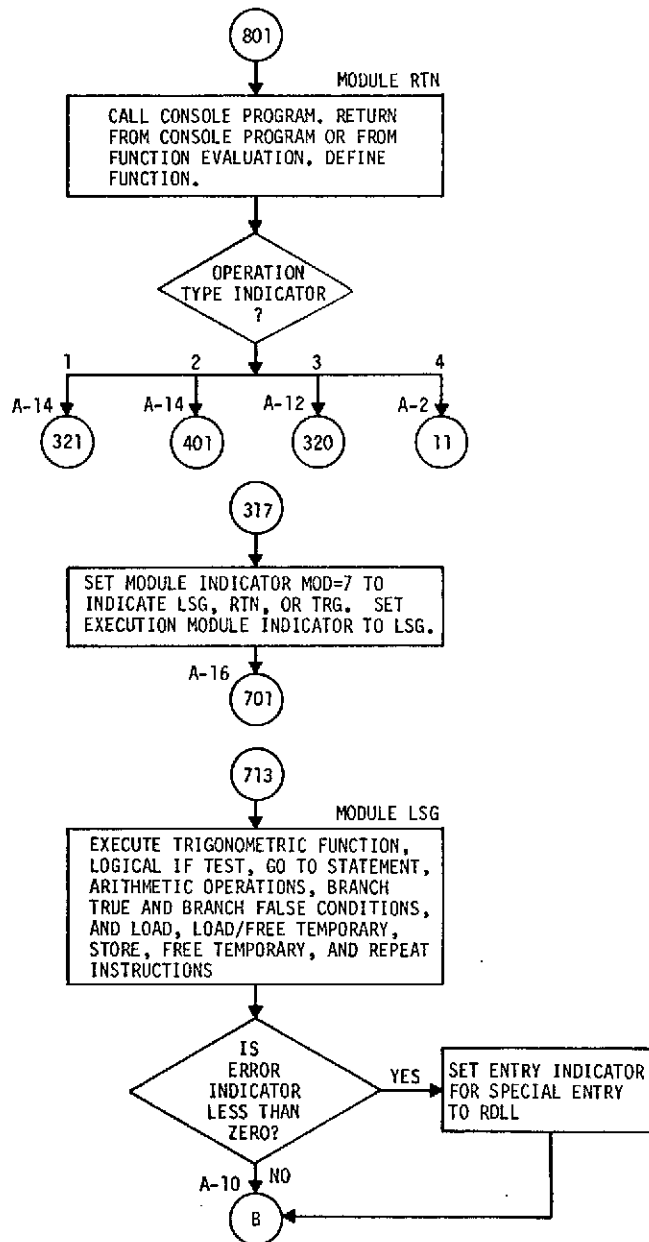


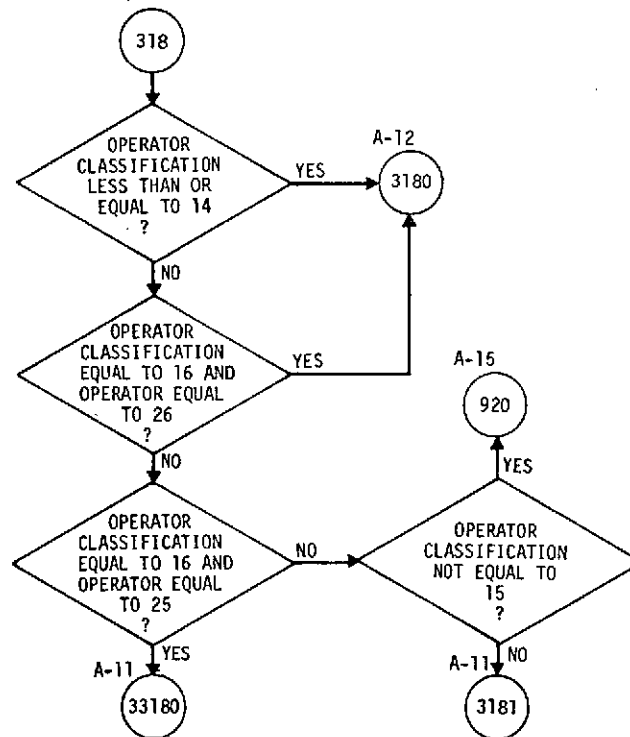
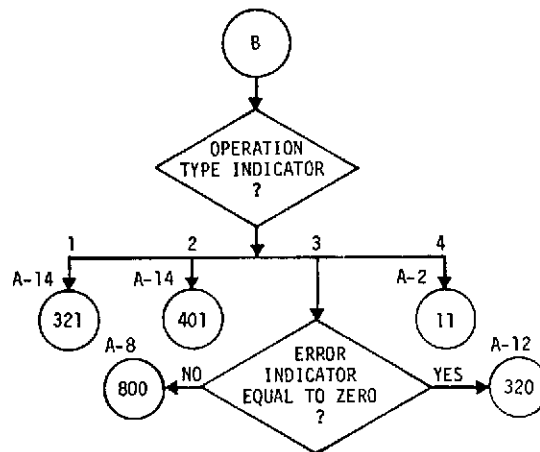


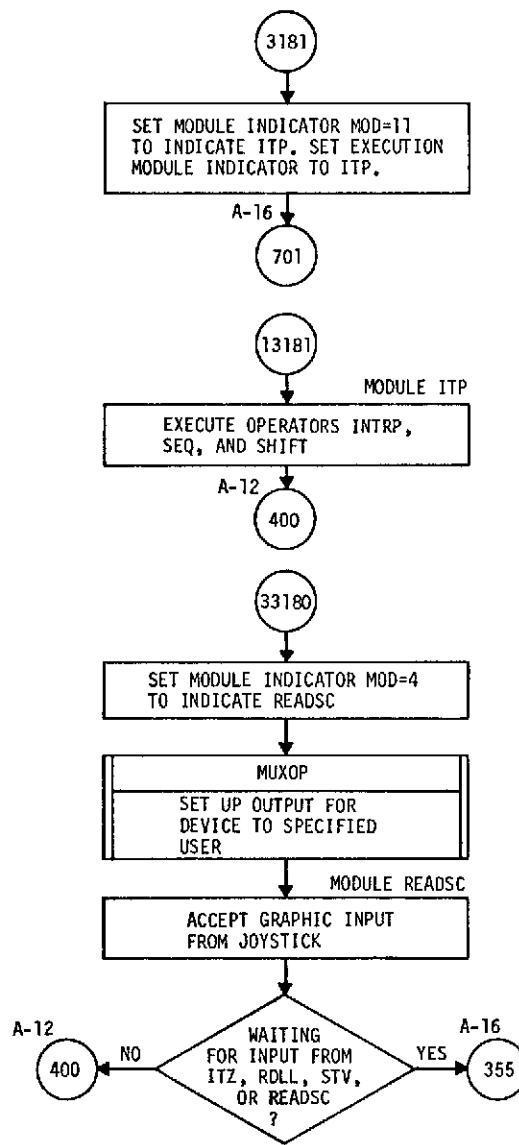


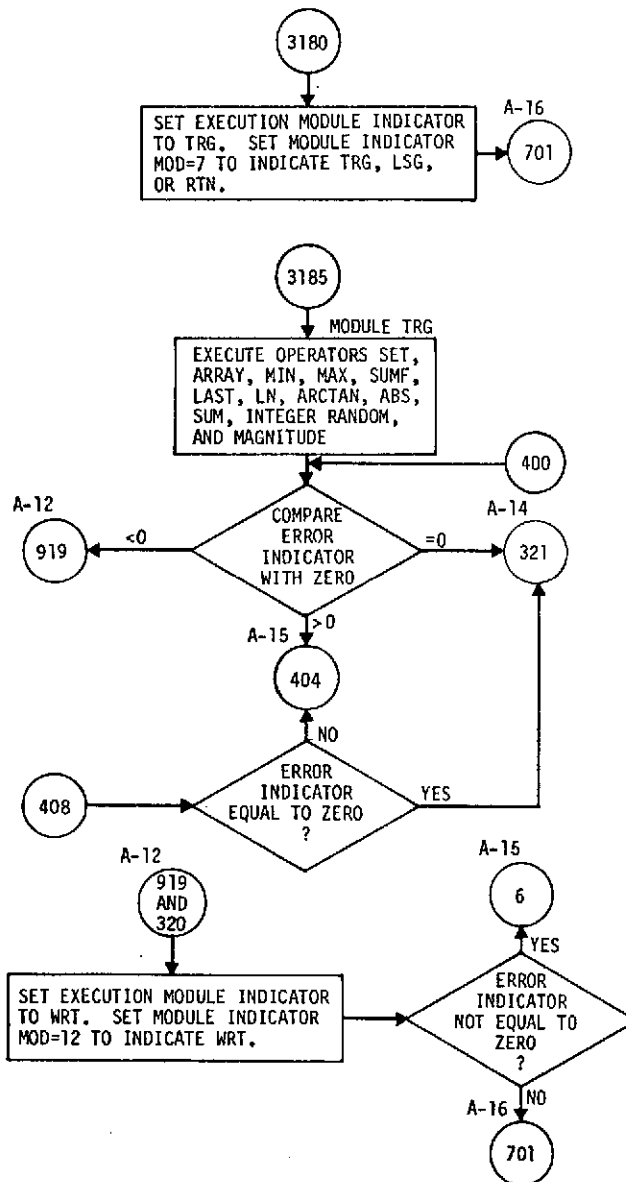


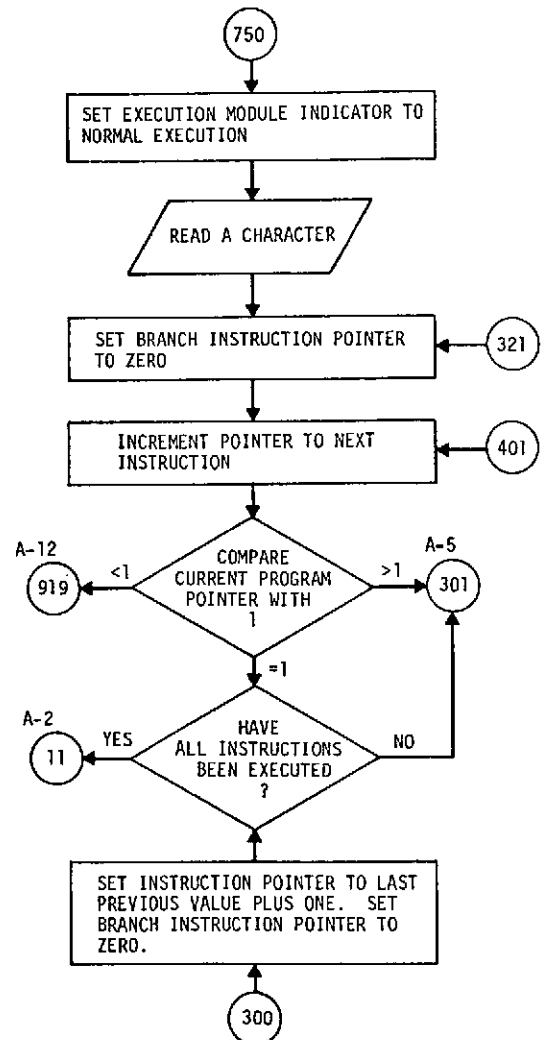
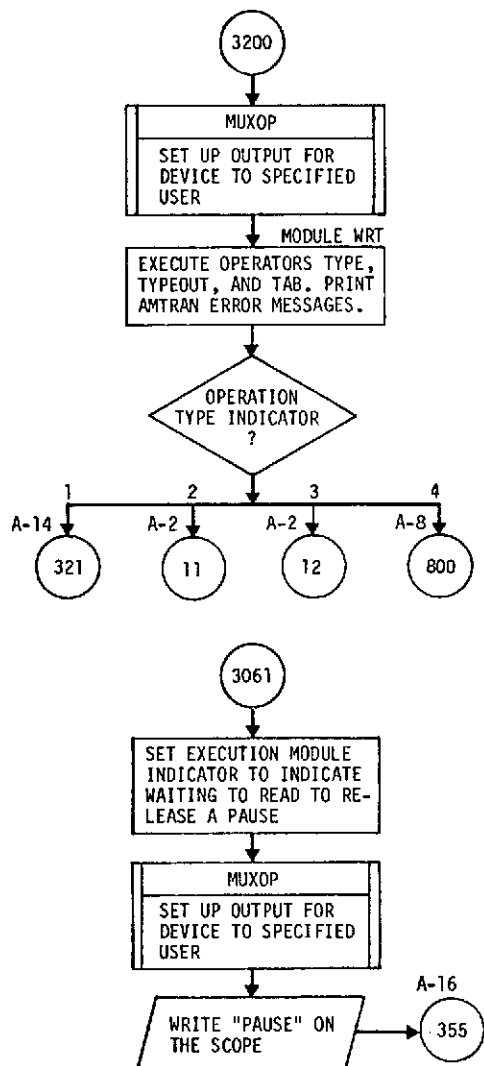


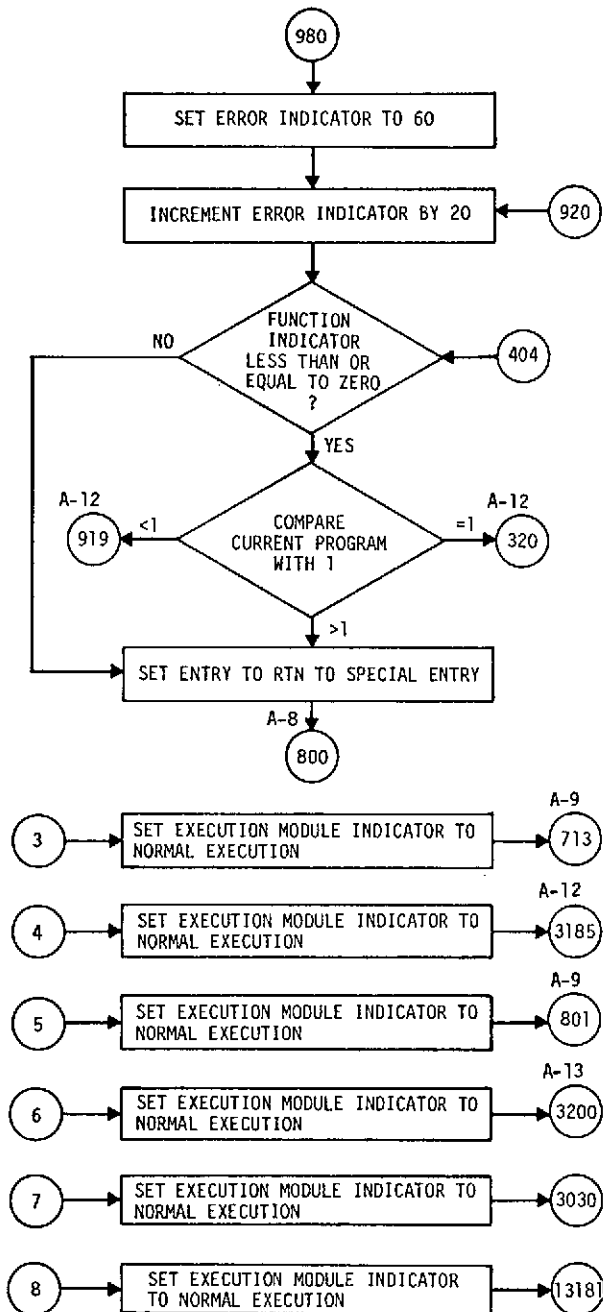


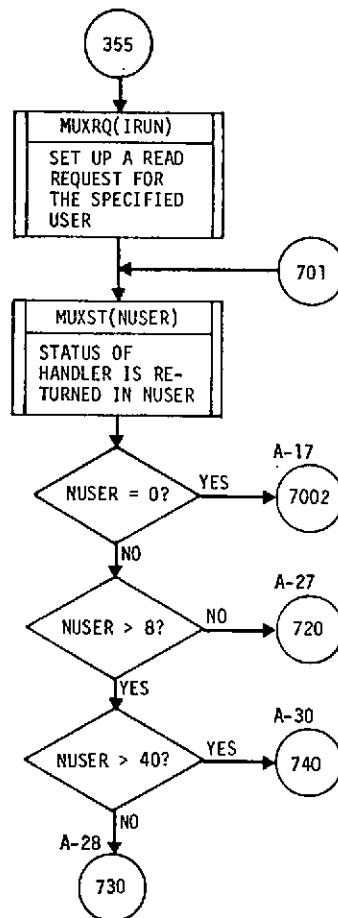












- RUN INDICATOR (IRUN) = N WHERE N IS THE USER WHO IS CURRENTLY RUNNING
- STATUS OF HANDLER (RETURNED IN NUSER)
 - = 0 NO BUFFERS FULL, NO CALLUPS, OR NO HANGUPS
 - = N USER N HAS FILLED A BUFFER
 - = 32+N USER N HAS CALLED UP
 - = 64+N USER N HAS HUNG UP

